National Science Bowl®
Saturday Seminars

April 30, 2005
National 4-H Conference Center
Chevy Chase, MD

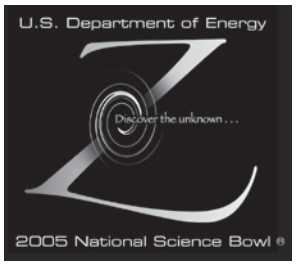
Seminars by Times and Locations

Room	Session I 9:00 - 10:15 a.m.
Aiton Auditorium	*Plenary Session: Einstein's Path to His 'Miracle Year'* *Dr. Donald Howard* *Facilitator: Aaron Schuetz*
	Session II 10:30 - 11:45 a.m.
Arkansas	*Plant Biotechnology, Biosafety & Landmines* *Dr. Neal Stewart* *Facilitator: JoAnn Rochon*
California	*The Potential and Challenge of Parallel Computing* *Dr. Robert Wisniewski* *Facilitator: Maqsood Mohammed*
Idaho	*Inside Forensics: Behind CSI* *Dr. Allen Christian.* *Facilitator: Linda Lung*
Illinois	*Neutrinos: The Tiniest Bits of Our Universe* *Dr. Bonnie Fleming* *Facilitator: Ray Ng*
Louisiana	*The Mathematics of Beauty & The Beauty of Math* *Dr. Monica Neagoy* *Facilitator: Bob Kuech*
Missouri	*Enhancement Activities* *Facilitators: Jan Tyler, Cynthia Feller*
Montana	*Nanotechnology: Fact & Fiction* *Dr. Paul Burrows* *Facilitator: Steve Woodruff*
Ohio	*Mr. Magnet's Science* *Mr. Paul Thomas "Mr. Magnet"* *Facilitator: Lorri Kirby*
Oklahoma	*Cosmology with the World Wide Telescope* *Dr. Alexander Szalay* *Facilitator: Linell Carter*

Room	Session III 1:30-2:45 p.m.
Arkansas	*Plant Biotechnology, Biosafety & Landmines* *Dr. Neal Stewart* *Facilitator: Bonnie Toole*
Idaho	*Inside Forensics: Behind CSI* *Dr. Allen Christian.* *Facilitator: Linell Carter*
Illinois	*Neutrinos: The Tiniest Bits of Our Universe* *Dr. Bonnie Fleming* *Facilitator: Barbara Billington*
Louisiana	*The Mathematics of Beauty & The Beauty of Math* *Dr. Monica Neagoy* *Facilitator: Beth Perry*
Missouri	*Enhancement Activities* *Facilitators: Jan Tyler, Cynthia Feller*
Montana	*Nanotechnology: Fact & Fiction* *Dr. Paul Burrows* *Facilitator: Ray Ng*
Ohio	*Mr. Magnet's Science* *Mr. Paul Thomas "Mr. Magnet"* *Facilitator: JoAnn Rochon*
Oklahoma	*Cosmology with the World Wide Telescope* *Dr. Alexander Szalay* *Facilitator: Bob Kuech*

Cover Illustrations from the National Science Bowl® Saturday Seminars, May 1, 2004.

Top row, third photo: Dr. James Sylvester Gates, Jr. discusses string theory. Bottom row, second photo: Jessica Collisson presents the Mars Exploration Rovers. Other photos: Teams participating in the model fuel cell car race competition and seminar activities, and competing in the bowl.



Looking for the "Z" to help study for the Science Bowl?

Choose any of the seminars that interest you on the previous pages for each session. If they all look good and you want to see which would benefit you in the competition, they are grouped below by National Science Bowl® question subject area.

Want to expand your ***Astronomy***? Observe page 14.

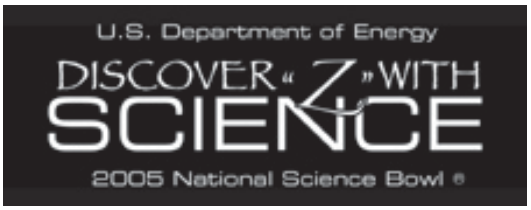
Need to enliven your ***Biology***? Look at pages 6, 8, and 12.

Inhibited on your ***Chemistry***? Read page 8.

Have a ***Math*** problem? Add up the facts on pages 10 and 14.

Need a lift on ***Physics***? Check out pages 5, 9, 12, and 13.

Question on ***General Science***? Go to all of them!



Einstein's Path to His 'Miracle Year' – 1879 to 1905

Dr. Donald Howard

Plenary Session
Aiton Auditorium
9:00 - 10:15

In 2005, we celebrate the centenary of Albert Einstein's *annus mirabilis*, his "miracle year," for it was in 1905, in just one volume of the German physics journal *Annalen der Physik*, that the 26-year-old patent clerk from Bern, Switzerland, published three papers that shook the foundations of physics. This seminar will trace the path that led the young Einstein to that remarkable achievement. What kind of education did he get as a young teenager in Munich, Germany? Why did he drop out of high school on his own initiative? How, then, did Einstein learn physics so well? And how could he have written three such revolutionary papers while working full time in a dreary patent office? We'll look at all sorts of interesting things, like Einstein's high school transcript, letters to his high school sweetheart (and her mother), and the love letters that he exchanged with his first wife while they were both students of physics in Zurich in the late 1890s.

Don Howard is Professor of Philosophy and Director of the History and Philosophy of Science Graduate Program at the University of Notre Dame. He earned a B.Sc. in physical sciences in 1971 from Michigan State University, and a Ph.D. in philosophy from Boston University in 1979. His research concerns mainly the history and philosophical foundations of twentieth-century physics and the history of the philosophy of science. He has also worked as an assistant and contributing editor for *The Collected Papers of Albert Einstein* and serves as coeditor (with John Stachel) of the *Einstein Studies* series (Birkhäuser). Recent work includes: "Albert Einstein's Philosophy of Science" in the *Stanford Encyclopedia of Philosophy* (http://plato.stanford.edu/entries/einstein-philscience/); "Who Invented the Copenhagen Interpretation? A Study in Mythology" *Philosophy of Science* (2005); and "Point Coincidences and Pointer Coincidences: Einstein on Invariant Structure in Spacetime Theories," in *History of General Relativity IV: The Expanding Worlds of General Relativity* (Hubert Goenner et al., eds.) (Birkhäuser, 1999). For further information see: http://www.nd.edu/~dhoward1

Plant Biotechnology, Biosafety and Landmines

Dr. Neal Stewart

Arkansas
10:30 - 11:45
1:30 - 2:45

Over 40 trillion genetically engineered plants have been grown in the U.S. during the past 10 years. While there are plenty of people who are still frightened about plant biotechnology and who are quick to point out risks, no ecological or food safety disasters have ever been caused by genetically engineered plants. The controversial points will be discussed, as well as some of the biosafety data collected in the past few years. Dr. Stewart's lab not only performs biosafety research, but is also investigating how genetically engineered plants can be used to detect and report on the presence of a plethora of contaminants in the environment including: chemical warfare agents, plant diseases and explosives. One especially intriguing application for genetically engineered plants is to map the location of buried landmines. Thus, there could be tremendous non-food environmental applications of plant biotechnology. Explore the world of functional genomics and biotechnology to learn the facts and myths about plant genetic engineering.

Neal Stewart holds the Racheff Chair of Excellence in plant molecular genetics and is a professor in the Department of Plant Sciences in the University of Tennessee. Dr. Stewart holds degrees from NC State and Virginia Tech with postdoctoral experience at the University of Georgia. Dr. Stewart's research spans plant genomics, physiology, and ecology. His research has been supported by various granting agencies, including the USDA, NSF, EPA, NASA and various U.S. military sources. Dr. Stewart teaches a graduate level course in plant genomics and has given presentations around the U.S. and in 10 countries. He has recently written a book on today's topic, "Genetically Modified Planet: the Environmental Impacts of Genetically Engineered Plants," published by Oxford University Press. He is married and has one teenage son who has no interest whatsoever in science.

The Potential and Challenge of Parallel Computing

Dr. Robert Wisniewski

California
10:30 - 11:45

Many problems require a tremendous amount of computation power to solve. These problems range from predicting the weather, to simulating the interaction of complex molecules, to playing that new cool video game. A single processor, as is found in a standard personal computer or even powerful workstation, is often not sufficient. Parallel processing involves connecting together many processors - tens to hundreds or even more - and coordinating them to work together to solve a problem. This talk will describe the potential offered by parallel computing, present some of the difficulties encountered attempting to take advantage of its potential, and present current research projects.

Dr. Robert William Wisniewski is currently a research scientist at IBM T.J. Watson and his research interests include scalable parallel systems, first-class system customization, and performance monitoring. He attended Cornell University and received his M.S. in Computer Science from the University of Rochester. He received his Ph.D. in 1996 and joined Silicon Graphics where he worked on Operating System design and bring-up for their high-end Origin servers. He then began work at IBM's T. J. Watson Research Center on the K42 scalable operating systems project (www.research.ibm.com/K42). The K42 project is a research effort aimed at designing from the ground up a scalable operating system targeted at small parallel machines expected to become ubiquitous, up to large-scale machines used in scientific computing. He has worked in wide variety of areas including system boot, memory management, performance monitoring and tracing, scheduling, and hot-swapping of live operating system resources. He owns patents ranging from debugging spreadsheets to low-level kernel lock optimizations, and has also made contributions to Linux, specifically contributing to the Linux Trace Toolkit. He is involved in the Continuous Program Optimization (www.research.ibm.com/CPO) effort, which is aimed at using vertically integrated performance data to automatically improve the performance of both applications and the underlying system.

Inside Forensics: Behind CSI

Allen Christian

Idaho
10:30 - 11:45
1:30 - 2:45

Ever wonder how crime scene investigators do their job? Where the tricks of their trade come from? Scientists at Lawrence Livermore National Laboratory work with crime labs to help develop cutting edge technologies to help analyze evidence, to track down and identify criminals. You'll learn how scientists work with law enforcement to develop new technologies that keep crime scene investigation on the cutting edge.

Allen Christian is Deputy Division Leader for the Biodefense Division in the Biology and Biotechnology Program (BBRP) Directorate. After receiving his B.S. degree in chemical engineering at the University of Colorado at Boulder, he took a position as a field engineer for Schlumberger, working in secondary oil recovery and well cementing. One year later, Allen enrolled at Colorado State University, Fort Collins for his Ph.D. in radiation biology, doing research in molecular cytogenetics and computer image analysis. He joined the Lawrence Livermore National Laboratory in 1998 as a postdoctoral fellow in BBRP to continue his work in this area. In 2000, Allen was invited to join BBRP as a staff scientist and has held several leadership positions within BBRP, as well as leading large biodetection projects in the Chem-Bio National Security Program. He has diverse research interests that include aspects of cancer research, bioengineering, and forensic analysis, and has published more than 20 papers in these areas.

Neutrinos: The Tiniest Bits of Our Universe

Dr. Bonnie Fleming

Illinois
10:30 - 11:45
1:30 - 2:45

Neutrinos are everywhere. These tiniest of the building blocks of matter come from space, our sun, the earth, nuclear reactors, particle accelerators, and a bunch (~100 per cubic centimeter) are just left over from the big bang. So why did it take almost 50 years to put these particles on a scale and figure out that they have mass? Well, it turns out that just "seeing" neutrinos in big particle detectors is a challenge. We will discuss how scientists see neutrinos in our universe and on our planet, massive neutrinos, and neutrino oscillations (which are strange phenomena of one type of neutrino spontaneously morphing into another type).

Bonnie T. Fleming is an Assistant Professor in the high energy physics group at Yale University. Her research focuses on high energy neutrino physics to study the nature of neutrinos and what neutrinos can tell us about the rest of the Standard Model of particle physics and the universe. As a graduate student at Columbia University, Bonnie studied proton structure by observing high energy neutrino-nucleon interactions at the NuTeV experiment at Fermilab. Following her Ph.D. work, Bonnie held a Lederman Fellowship at Fermilab working on the MiniBooNE experiment, searching for neutrino oscillations. If MiniBooNE observes an oscillation, or change, of a muon-type neutrino into an electron-type neutrino, this will be an indication of new physics, such as a new type of neutrino. Bonnie is currently proposing the FINeSSE experiment, designed to use neutrinos to probe the still not well-understood spin structure of the proton. Currently working at Yale, Bonnie is starting up an R&D program for precision neutrino detectors for the next generation of neutrino physics experiments.

The Mathematics of Beauty and The Beauty of Mathematics

Dr. Monica Neagoy

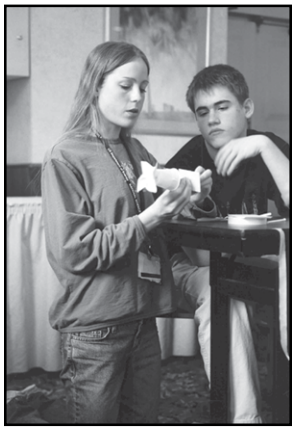
Louisiana
10:30 - 11:45
1:30 - 2:45

Whether beauty is subjective or objective, ephemeral or eternal, arouses the senses or charms the intellect, its definition has forever challenged philosophers and artists alike. This multimedia presentation invites you to ponder the meanings of beauty, examine the mathematics behind things beautiful, and enjoy aspects of mathematics that delight students, teachers, mathematicians, math educators, and lovers of mathematics.

Dr. Monica Neagoy has a B.S. in mathematics and philosophy from Georgetown University, an MA in Mathematics from The Catholic University of America, and a Ph.D. in Mathematics Education from The University of Maryland. Dr. Neagoy taught in the department of mathematics at Georgetown University from 1980 to 1985. In 1985, she founded the Mathematics Articulation Program (MAP), a collaboration between the Mathematics Department and the School for Summer and Continuing Education, for area mathematics teachers. The MAP soon became a national program, and Dr. Neagoy left to form her own consulting firm for presenting workshops on innovative ways to teach math. She has consulted for the MATHCOUNTS Foundation, Carnegie Academy for Mathematics Education, National Annenberg/CPB Channel, andPBS Teacherline's Virtual Math Academy. Dr. Neagoy served a three-year rotation as a national program director in the Division of Elementary, Secondary and Informal Education for the National Science Foundation.

When she is not wearing her "mathematics hat," Dr. Neagoy is most often wearing her "theatre hat." In her evening-and-weekend life, she was the co-artistic director of the professional LE NEON Theatre in the Washington D.C. area for 15 years, where she directed, performed, did set design, choreography, dramaturgy and French-English translation. She and artistic director, Didier Rousselet, received many Helen Hayes nominations and awards, and other national and international theatre awards for their work. Dr. Neagoy had the lead female role in the film, *Five Days in Paris*, which was part of the annual FILMFEST DC, about 10 years ago.

Hands-On Science Activities (Students Only)



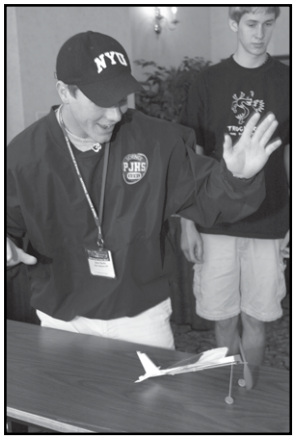
Missouri
10:30 - 11:45
1:30 - 2:45

The top three teams participating will receive prizes.

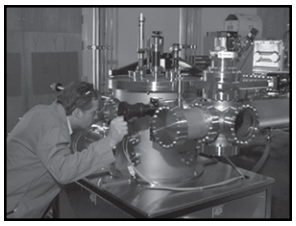
Work and Power - Build a machine that operates on wind power you provide and calculate the work the machine does and the power it required.

Go-Far Cars - Predict how far a model car will go off a ramp at a given height.

Go-Fast Cars - Build a balloon-powered car that will cross the finish line first.



Nanotechnology: Fact & Fiction, Fantasy & Reality



Dr. Paul Burrows

Montana
10:30 - 11:45
1:30 - 2:45

Scientists in the classic sci-fi movie, "Fantastic Voyage," were miniaturized and traveled through the bloodstream to destroy a life-threatening blood clot in a human's brain. Miniaturizing humans is likely to remain the stuff of science fiction, but using tiny molecules to detect and guard against bioweapons is a real possibility. This is one example of a broad new area of engineering collectively known as "nanotechnology." Encouraged by the promise of new materials built atom-by-atom from the bottom up, investment in nanotechnology has soared over the past decade, led by the U.S. government's National Nanotechnology Initiative. In this lecture, we will explore the real meaning and importance of "nano" and illustrate ways in which nanofabrication can provide critical materials solutions to problems in energy and security. We will explore and contrast the reality of nanotechnology as it stands now, the promise and pitfalls of the near future, and some of the fears and fantasies which will likely remain in the realm of science fiction.

Dr. Paul Burrows is a Laboratory Fellow at Pacific Northwest National Laboratory (PNNL) in the Energy Science and Technology Division. Dr. Burrows also serves as Manager of the Nanoscience and Nanotechnology Initiative, which is one of a handful of transforming initiatives at PNNL. Prior to his employment at Battelle – PNNL, Dr. Burrows was a Research Scholar at Princeton University in the Department of Electrical Engineering. He earned his B.S. and Ph.D. in Physics from the University of London. His work has been instrumental in the creation of two new companies: Universal Display Corporation, currently a NASDAQ-listed company developing a portfolio of intellectual property, based on work performed at the Princeton University laboratories; and Vitex Systems, a company spun off from Battelle to develop flexible encapsulation technology for organic light emitting displays. He is also currently leading projects in the area of organic and hybrid thin film deposition, particularly organic electroluminescent display engineering, nonlinear optical materials, hybrid organic-inorganic semiconductor integration and three dimensional electronic devices using organic materials. He is a co-author of over 100 publications and 64 issued U.S. patents, mostly in the area of organic semiconductors.

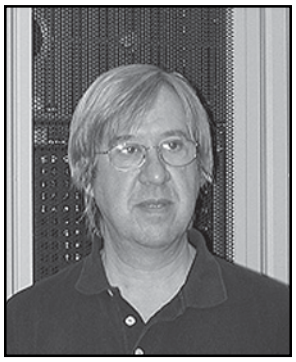
Mr. Magnet's Science
Mr. Paul Thomas

Ohio
10:30 - 11:45
1:30 - 2:45

Take a mesmerizing journey of discovery into the fascinating realm of magnetic phenomena. Paul Thomas, better known at MIT as Mr. Magnet, will uncover before your eyes the secret forces of ferromagnetism and magneto-electricity. What mysterious force field holds steady an aluminum fry pan suspended in space? A magnetic impulse launches Garfield into space and with sudden forceful energy bends metal into a useful shape. Light up the White House by generating electric energy with your muscle power. How many watts can you generate? If you dare, discharge one million volts of electric potential holding a lightning rod in your bare hands. The Mr. Magnet show is just for the fun of it.

Mr. Paul Thomas is currently a Plasma Science and Fusion Center Technical Supervisor at MIT. After graduating from technical school, Mr. Thomas joined High Voltage Engineering Corporation, where he worked under the guidance of Robert J. Van de Graaff to develop high voltage apparatus for research. He pursued a degree in electrical engineering at Northeastern University. Mr. Thomas joined the Massachusetts Institute of Technology in 1983, where as part of a team of scientists and engineers, he supervised the integration of computer controls on a large-scale fusion experiment. Nine years later, Mr. Thomas began his educational outreach by building a series of demonstrations and bringing them in a van into Boston area schools. In the nine years since the first school visit, Mr. Magnet has presented the program to nearly 300,000 students and teachers in the New England region. The show has also traveled to New Orleans, Atlanta, and Washington, D.C. for special events.

Cosmology with the World Wide Telescope



Dr. Alexander Szalay

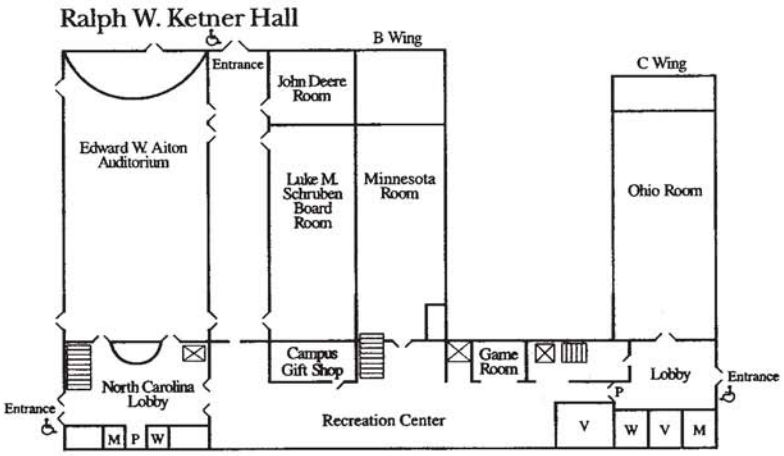
Oklahoma
10:30 - 11:45
1:30 - 2:45

Astrophysics is collecting data about the Universe at an unprecendented rate. Today, cosmology is turning into a precision science. We are within reach to understand some of the most fundamental questions of cosmology. Much of the data is on-line and accessible to everyone, including high school students. The talk will present an overview of the most interesting questions of cosmology today, the nature of dark matter and dark energy, and the different approaches how astrophysicists seek answers to these exciting questions. The physics involved connect the smallest and largest known scales in our Universe.

Alexander Szalay is the Alumni Centennial Professor of Astronomy at the Johns Hopkins University. He is also Professor in the Department of Computer Science. He is a cosmologist, working on the statistical measures of the spatial distribution of galaxies and galaxy formation. He was born and educated in Hungary. After graduation he spent postdoctoral periods at UC Berkeley and the University of Chicago, before accepting a faculty position at Johns Hopkins. In 1990, he was elected to the Hungarian Academy of Sciences as a Corresponding Member. He is the architect for the Science Archive of the Sloan Digital Sky Survey. He has been collaborating with Jim Gray of Microsoft to design an efficient system to perform data mining on the SDSS Terabyte sized archive, based on innovative spatial indexing techniques. He is leading a grass-roots standardization effort to bring the next generation Terabyte-sized databases in astronomy to a common basis, so that they will be interoperable – the Virtual Observatory. He is Project Director of the NSF-funded National Virtual Observatory. He is involved in the GriPhyN and iVDGL projects, creating testbed applications for the Computational Grid. He has written over 300 papers in various scientific journals, covering areas from theoretical cosmology to observational astronomy, spatial statistics and computer science.

Thank you to all our Seminar Speakers for sharing their time and energy so that the participants of the 2005 National Science Bowl® could Discover "Z" with Science.

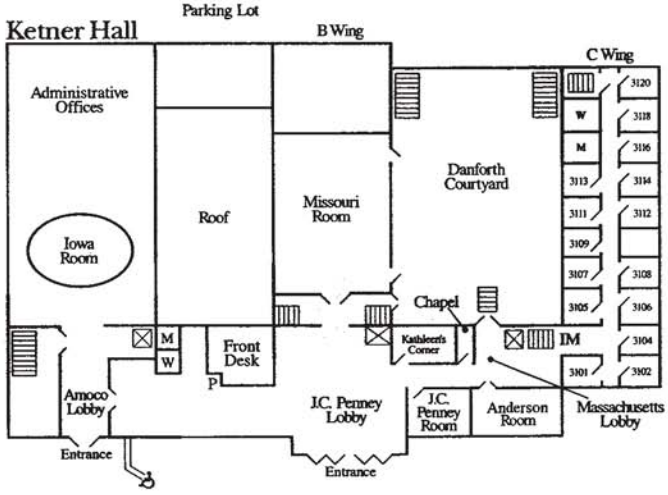
Interior Campus Map



Lower Level

J.C. PENNEY HALL

ROOMS 3101-3120



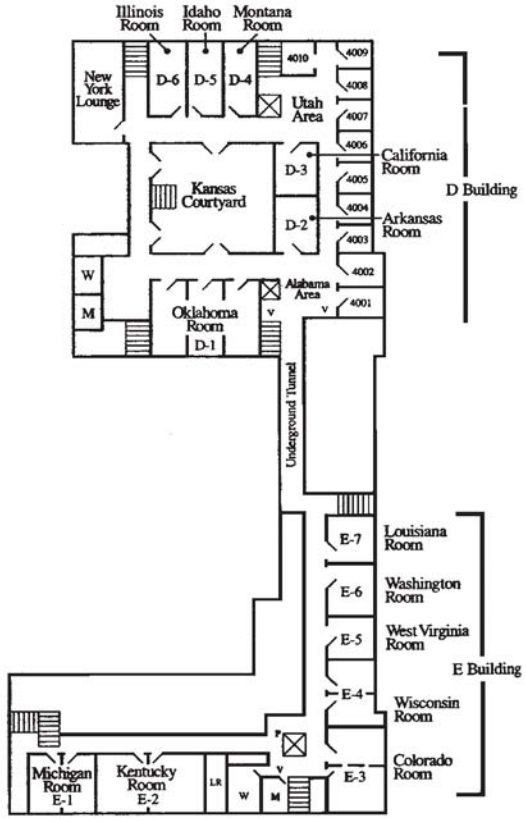
Ground Floor

ROOMS 4001-4010

FIRESTONE HALL

MCCORMICK HALL

W.K. KELLOGG HALL



Lower Level

KEY

- ELEVATORS
- STAIRS
- M W — REST ROOMS
- LR — LAUNDRY ROOM
- IM — ICE MACHINES
- V — VENDING MACHINES
- P — PHONE
- ♿ — ACCESSIBLE ENTRANCE